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GB A 2069338
GB 1573608
GB 1504055
GB 1483938
GB 1476786
GB 1469567
GB 1409123
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(54) Improvements in prosthesis

(57) A prosthesis for replacing a joint between two bones in which a pair of members are adapted for securing to respective bones and one of the members comprises a resilient element for absorbing or reducing the effect of shocks applied to the joint. In the case of a hip joint, the resilient element is preferably comprised in a member adapted for securing to the acetabulum. The surface of each member which contacts a surface of the other member is preferably formed by a coating of a ceramic material on a metal part.

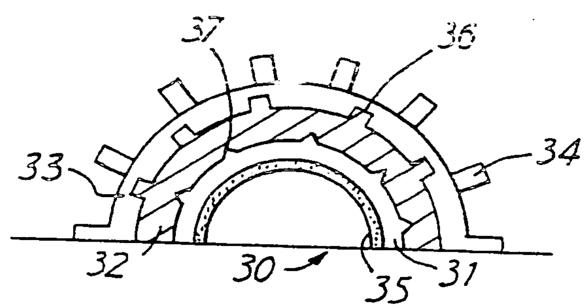

FIG. 3

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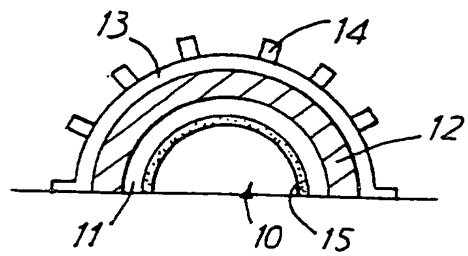

FIG. 1

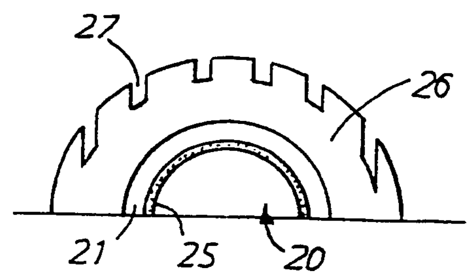

FIG. 2

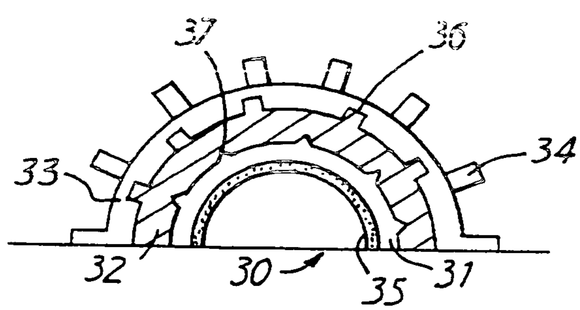

FIG. 3

SPECIFICATION

Improvements in prostheses

This invention relates to prostheses for replacing hip joints.

In a total hip prosthesis which has an all-metal, all-ceramic, or partly metal and partly ceramic construction, the lack of any significant natural resilience in these materials can give rise to problems. This is particularly the case for younger, more active patients.

In each type of construction, violent jarring of the joint may result in a breaking or loosening of the bond between the bone and an acrylic cement which secures part of the prosthesis thereto, or of the bond between the cement and the part of the prosthesis.

According to the invention a hip prosthesis comprises a first member which is formed with a stem for fitting into a femur and with a part-spherical head, and a second member which is adapted for securing to an acetabulum and is formed with a part-spherical cavity for receiving the head of the first member, contacting surfaces of the head and the cavity serving as bearing surfaces during relative movement between the members wherein one of the members comprises a resilient element for absorbing or reducing the effect of shocks applied to the prosthesis.

Preferably, the second member comprises the resilient element.

The second member may then comprise two parts each formed as a generally hemispherical shell, and the said resilient element, which is located between the two parts.

At least one of the two parts may be formed with spikes, studs or the like projections which are embedded in the resilient element. At least one of the two parts may be formed with grooves or the like indentations, material of the resilient element extending into the said grooves or the like indentations when the prosthesis is in use.

The combination in a prosthesis of a ceramic ball with a ceramic cup provides a very low coefficient of friction between the ball and cup, exceptionally good wearing properties and chemical inertness with respect to body tissues. The drawback to an otherwise satisfactory artificial joint is the brittleness and lack of resilience of the ceramic material. In a preferred form of hip prosthesis according to the invention, this limitation is overcome by incorporating a resilient, shock absorbing element in the acetabular member.

With a normal ceramic cup, the wall thickness necessary to avoid fracture, or cracking and consequent catastrophic failure of the joint, may preclude the incorporation of a resilient or shock absorbing element, since the overall diameter of the cup would then become too great to be fitted into the acetabulum without removing an unacceptably large volume of bone. To produce an equivalent of a ceramic cup with a sufficient thin wall, the technique of high temperature ceramic coating may then be used to produce a thin coating of a ceramic material on an inner surface of a thin metal cup. This metal cup is then bonded to a resilient element, which in turn is bonded to an outer metal shell which is cemented into the acetabulum.

The invention will now be described, by way of example, with reference to the accompanying drawings, in which :—

Figures 1, 2 and 3 are schematic diagrams of parts of prostheses according to the invention.

Referring to Figure 1 of the drawings, a first embodiment of the invention is a total hip prosthesis made up of a first member (not shown) which, in use, is secured to the patient's femur and a second member 10 for securing to the acetabulum.

The first member includes a metal stem and a head or ball of metal or ceramic material. The metal stem is elongated and curved and, in use, is fitted into an upper end of the femur and secured therein by cement. A part-spherical outer surface of the head or ball is designed to contact an inner concave surface of the second member. In the case of a metal head or ball, the part-spherical surface is coated with a ceramic material.

The second member 10 is generally hemispherical and includes an inner part 11, an outer part 13 and a resilient element 12 which is sandwiched between the parts 11 and 13.

The outer part 13 is a hemispherical metal shell having a radial thickness of 1.5 to 4 mms. A series of studs 14 is formed at spaced intervals on an outer surface of the part 13, the studs serving as keys which assist in cementing the part 13 to the patient's acetabulum.

Bonded to an inner surface of the part 13 is the resilient element 12, which is made of silicone rubber, polyurethane, impregnated woven carbon fibre or any other resilient material having sufficient strength to withstand the loadings applied in use and suitable for implantation in human tissues without toxic effect. Suitably, the element 12 has a radial thickness of 2 to 4 mms.

The inner part 11 is a second hemispherical metal shell which has a radial thickness of 2 to 3 mms. and is bonded to an inner surface of the element 12. A thin coating 15 of aluminium oxide (Al_2O_3) is bonded to an inner concave surface of the part 11 by means of a known high temperature spraying process. The coating 15 is ground and highly polished to match the part-spherical surface of the head or ball on the first member.

For bonding the element 12 to the parts 11 and 13, a bonding agent which is compatible with the material of the element and is not attacked by body fluids is employed.

In use, any shocks sustained by the limb are absorbed or greatly reduced by compression of the resilient element 12.

Figure 2 shows a second embodiment of the invention having a second member 20 formed of a part 21 and a resilient element 26. In this second embodiment the part 21 is a

hemispherical metal shell having a concave inner surface coated with a ceramic layer 25.

The part 21 is fitted into the element 26, which is a generally hemispherical shell of resilient material, such as silicone rubber, polyurethane, reinforced woven carbon fibre or other resilient plastics or rubber compound suitable for implantation in human tissues. The element 26 is sufficiently resilient to provide shock absorbing properties but sufficiently rigid to enable the element to be firmly cemented into the acetabulum.

An outer surface of the element 26 is formed with grooves 27 which are cut in one or more directions and provide a key for cement used in securing the element to the acetabulum. Alternatively, an outer surface of the element 26 is formed with studs.

In use, shocks sustained by the limb are absorbed or greatly reduced by the resilient element 26.

Referring to Figure 3 of the drawings, a third embodiment of the invention is similar and the first embodiment in that a second member 30 of the prosthesis has a resilient element 32 sandwiched between an inner part 31 and an outer part 33.

In this third embodiment, the inner and outer parts 31 and 33, respectively, are again formed as hemispherical metal shells and there are again studs 34 on an outer surface of the part 33 and a coating 35 of aluminium oxide or on an inner surface of the part 31. In addition, a series of sharp-edged grooves 36 or other indentations is formed on an inner surface of the part 33 and a series of projections in the form of spikes or studs 37 is formed on an outer surface of the part 31.

In assembling the member 30, the element 32 is bonded to each of the parts 31 and 33. Additionally, pressure is applied between the parts 31 and 33 so that the resilient element 32 tends to flow into the grooves 36 and the spikes or studs 37 become embedded in the element 32. Engagement of the element 32 with the grooves 36 and the spikes or studs 37 assists the bonding material in preventing relative rotational movement between the element 32 and the parts 31 and 33.

The embodiment of Figure 3 can be modified by replacing the grooves 36 by studs or spikes and/or replacing the studs or spikes 37 by grooves or other indentations.

In a further modification of the embodiment of Figure 3 the resilient element 32 is preformed and is not bonded to either of the parts 31 and 33. Relative rotational movement between the element 32 and the parts 31 and 33 is then prevented by engagement between the element and the studs or spikes and the grooves or indentations on each of the parts. In the event of some failure of the prosthesis the inner part 31 and the resilient element 32 are then readily removed and replaced, if necessary, without any need to disturb the cement between the part 33 and the acetabulum. It will be appreciated that the part 33 is usually the most difficult part to remove without causing damage to what is frequently a fragile and barely adequate bone structure.

In a further embodiment of the invention, not shown in the drawings, a resilient element is included in a first member adapted for securing to a femur and formed of a stem and a part-spherical head. The second member may then be a rigid member or it may also include a resilient element.

In this further embodiment, the resilient element in the first member suitably takes the form of a part-spherical shell sandwiched between an inner, part-spherical metal part and an outer part-spherical metal shell.

Claims

1. A hip prosthesis comprising a first member which is formed with a stem for fitting into a femur and with a part-spherical head, and a second member which is adapted for securing to an acetabulum and is formed with a part-spherical cavity for receiving the head of the first member, contacting surfaces of the head and the cavity serving as bearing surfaces during relative movement between the members, wherein one of the members comprises a resilient element for absorbing or reducing the effect of shocks applied to the prosthesis.

2. A prosthesis as claimed in Claim 1, wherein the resilient element is comprised in the second of the members.

3. A prosthesis as claimed in Claim 2, wherein the second member comprises two parts, each formed as a generally hemispherical shell, and the said resilient element, which is located between the two parts.

4. A prosthesis as claimed in Claim 3, wherein at least one of the two parts is formed with spikes, studs or the like projections which are embedded in the resilient element.

5. A prosthesis as claimed in Claim 3 or 4, wherein at least one of the two parts is formed with grooves or the like indentations, material of the resilient element extending into the said grooves or the like indentations when the prosthesis is in use.

6. A prosthesis as claimed in any one of Claims 3 to 5, wherein the resilient element is bonded to at least one of the two parts of the second member.

7. A prosthesis as claimed in Claim 2, wherein the second member comprises the resilient element, which is generally hemispherical and adapted for securing to an acetabulum, and a generally hemispherical part fitted into the resilient to element.

8. A prosthesis as claimed in any one of the preceding claims, wherein each of the bearing